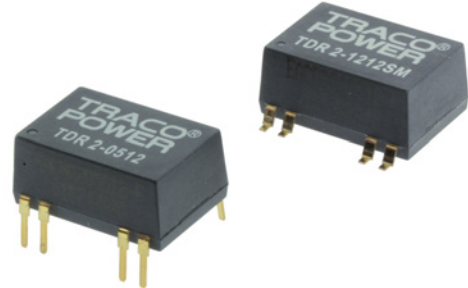


### Features

- ◆ Compact design in SMD or DIP package
- ◆ Wide 2:1 input voltage range
- ◆ Fully regulated outputs
- ◆ Low ripple and noise
- ◆ No minimum load required
- ◆ Temperature range -40°C to +85°C without derating
- ◆ I/O isolation 1500 VDC
- ◆ Continuous short-circuit protection
- ◆ Remote On/Off control
- ◆ Fully RoHS compliant
- ◆ 3-year product warranty



The TDR-2 series is a family of compact 2 W dc/dc-converters with 2:1 input voltage ranges and tightly regulated output voltages even under no load conditions. The product is available in SMD-package or in DIP-package. They work with high efficiency over the full load range and come with a remote On/Off input.

The usability in temperature ranges of up to 85°C without power derating, continuous short circuit protection and excellent immunity against environmental influences make these converters very reliable.

A TDR-2 converter is the ideal solution for space critical high end applications in communication equipment, instrumentation and industrial electronics.

### Models

| Order code<br>DIP models | Order code<br>SMD models | Input voltage range              | Output voltage | Output current<br>max. | Efficiency typ. |
|--------------------------|--------------------------|----------------------------------|----------------|------------------------|-----------------|
| TDR 2-0511               | TDR 2-0511SM             | 4.5 – 9.0 VDC<br>(5 VDC nominal) | 5.0 VDC        | 400 mA                 | 80 %            |
| TDR 2-0512               | TDR 2-0512SM             |                                  | 12 VDC         | 167 mA                 | 81 %            |
| TDR 2-0513               | TDR 2-0513SM             |                                  | 15 VDC         | 134 mA                 | 83 %            |
| TDR 2-0522               | TDR 2-0522SM             |                                  | ±12 VDC        | ±83 mA                 | 81 %            |
| TDR 2-0523               | TDR 2-0523SM             |                                  | ±15 VDC        | ±67 mA                 | 82 %            |
| TDR 2-1211               | TDR 2-1211SM             | 9 – 18 VDC<br>(12 VDC nominal)   | 5.0 VDC        | 400 mA                 | 81 %            |
| TDR 2-1212               | TDR 2-1212SM             |                                  | 12 VDC         | 167 mA                 | 81 %            |
| TDR 2-1213               | TDR 2-1213SM             |                                  | 15 VDC         | 134 mA                 | 84 %            |
| TDR 2-1222               | TDR 2-1222SM             |                                  | ±12 VDC        | ±83 mA                 | 83 %            |
| TDR 2-1223               | TDR 2-1223SM             |                                  | ±15 VDC        | ±67 mA                 | 82 %            |
| TDR 2-2411               | TDR 2-2411SM             | 18 – 36 VDC<br>(24 VDC nominal)  | 5.0 VDC        | 400 mA                 | 81 %            |
| TDR 2-2412               | TDR 2-2412SM             |                                  | 12 VDC         | 167 mA                 | 84 %            |
| TDR 2-2413               | TDR 2-2413SM             |                                  | 15 VDC         | 134 mA                 | 84 %            |
| TDR 2-2422               | TDR 2-2422SM             |                                  | ±12 VDC        | ±83 mA                 | 84 %            |
| TDR 2-2423               | TDR 2-2423SM             |                                  | ±15 VDC        | ±67 mA                 | 84 %            |
| TDR 2-4811               | TDR 2-4811SM             | 36 – 75 VDC<br>(48 VDC nominal)  | 5.0 VDC        | 400 mA                 | 81 %            |
| TDR 2-4812               | TDR 2-4812SM             |                                  | 12 VDC         | 167 mA                 | 82 %            |
| TDR 2-4813               | TDR 2-4813SM             |                                  | 15 VDC         | 134 mA                 | 82 %            |
| TDR 2-4822               | TDR 2-4822SM             |                                  | ±12 VDC        | ±83 mA                 | 83 %            |
| TDR 2-4823               | TDR 2-4823SM             |                                  | ±15 VDC        | ±67 mA                 | 83 %            |

## Input Specifications

|                                                                                   |                                                                                                                                                                                   |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Input current at no load</b> (nominal input voltage)                           | 5 Vin models: 40 mA typ.<br>12 Vin models: 20 mA typ.<br>24 Vin models: 10 mA typ.<br>48 Vin models: 7 mA typ.                                                                    |
| <b>Input current at full load</b> (nominal input voltage)                         | 5 Vin models: 520 mA typ.<br>12 Vin models: 215 mA typ.<br>24 Vin models: 105 mA typ.<br>48 Vin models: 55 mA typ.                                                                |
| <b>Surge voltage</b> (1 sec. max.)                                                | 5 Vin models: 15 V max.<br>12 Vin models: 25 V max.<br>24 Vin models: 50 V max.<br>48 Vin models: 100 V max.                                                                      |
| <b>Input filter</b>                                                               | capacitor type (see EMC considerations page 3 for compliance to EN 55022 class A/B)                                                                                               |
| <b>ESD</b> (electrostatic discharge)                                              | EN 61000-4-2, air $\pm 8$ kV, contact $\pm 6$ kV, perf. criteria A                                                                                                                |
| <b>Radiated immunity</b>                                                          | EN 61000-4-3 10 V/m, perf. criteria A                                                                                                                                             |
| <b>Fast transient / Surge</b>                                                     | EN 61000-4-4, $\pm 2$ kV, perf. criteria A<br>EN 61000-4-5, $\pm 1$ kV perf. criteria A<br>with external input capacitor e.g. Nippon chemi-con KY 220 $\mu$ F, 100 V, ESR 48 mOhm |
| <b>Conducted immunity</b>                                                         | EN 61000-4-6, 10 Vrms, perf. criteria A                                                                                                                                           |
| <b>Reflected ripple current</b><br>(measured with input filter according class A) | 5 Vin models: 80 mAp-p typ.<br>12 Vin models: 40 mAp-p typ.<br>24 Vin models: 30 mAp-p typ.<br>48 Vin models: 20 mAp-p typ.                                                       |

## Output Specifications

|                                                         |                                                                                                                                                                                                                                            |                                                                                                                                                                                                                       |
|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Voltage set accuracy                                    |                                                                                                                                                                                                                                            | ±1 % max                                                                                                                                                                                                              |
| Regulation                                              | <ul style="list-style-type: none"> <li>– Input variation <math>V_{in}</math> min. to <math>V_{in}</math> max.</li> <li>– Load variation 0 – 100 %</li> <li>– Load variation 10 – 90 %</li> <li>– Load cross regulation 25/100 %</li> </ul> | 0.2 % max.<br>single output models: 1.0 % max.<br>dual output models: 1.0 % max. balanced load<br>single output models: 0.5 % max.<br>dual output models: 0.8 % max. balanced load<br>5.0 % max. (dual output models) |
| Minimum load                                            |                                                                                                                                                                                                                                            | 0 % of rated max. load                                                                                                                                                                                                |
| Temperature coefficient                                 |                                                                                                                                                                                                                                            | ±0.02 %/K                                                                                                                                                                                                             |
| Ripple and noise (20 MHz bandwidth)                     |                                                                                                                                                                                                                                            | 30 mVp-p typ.                                                                                                                                                                                                         |
| Start up time (constant resistive load)                 | <ul style="list-style-type: none"> <li>– Power On</li> <li>– Remote On</li> </ul>                                                                                                                                                          | 5 ms typ.<br>5 ms typ.                                                                                                                                                                                                |
| Transient response setting time (25 % load step change) |                                                                                                                                                                                                                                            | 250 µs typ.                                                                                                                                                                                                           |
| Short circuit protection                                |                                                                                                                                                                                                                                            | indefinite, automatic recovery                                                                                                                                                                                        |
| Capacitive load                                         | 5 VDC models:<br>12 VDC models:<br>15 VDC models:<br>±12 VDC models:<br>±15 VDC models:                                                                                                                                                    | 1680 µF max.<br>820 µF max.<br>680 µF max.<br>±470 µF max.<br>±330 µF max.                                                                                                                                            |

## General Specifications

|                    |                                                |                                                                     |
|--------------------|------------------------------------------------|---------------------------------------------------------------------|
| Temperature ranges | - Operating<br>- Storage<br>- Case temperature | -40°C to +85°C (with no derating)<br>-55°C to +125°C<br>+100°C max. |
|--------------------|------------------------------------------------|---------------------------------------------------------------------|

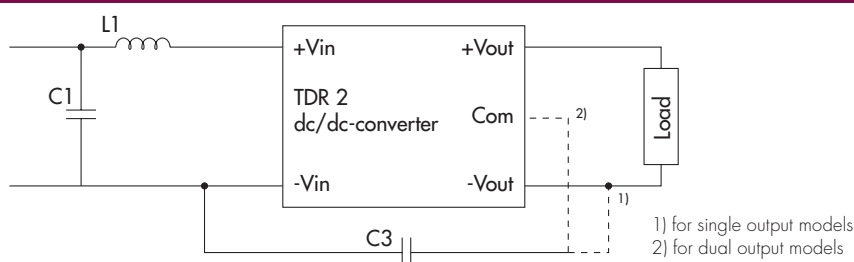
All specifications valid at nominal input voltage, full load and +25°C after warm-up time unless otherwise stated.

## General Specifications

|                                                                       |                                                                                                                                         |
|-----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Humidity (non condensing)                                             | 5 % to 90 % rel. H max.                                                                                                                 |
| Thermal shock                                                         | acc. MIL-STD-810F                                                                                                                       |
| Vibration                                                             | acc. MIL-STD-810F                                                                                                                       |
| Reliability, calculated MTBF (MIL-HDBK-217F, at +25°C, ground benign) | >2.8 Mio h                                                                                                                              |
| Isolation voltage (60sec.) – Input/Output                             | 1500 VDC                                                                                                                                |
| Isolation capacitance – Input/Output                                  | 50 pF max.                                                                                                                              |
| Isolation resistance – Input/Output (500 VDC)                         | >10 GOhm                                                                                                                                |
| Altitude during operation                                             | tba.                                                                                                                                    |
| Safety standard (designed to meet)                                    | IEC/EN 60950-1, UL 60950-1                                                                                                              |
| Safety approvals – UL/cUL                                             | <a href="http://www.ul.com">www.ul.com</a> -> certifications -> File: e188913                                                           |
| Switching frequency                                                   | 100 kHz (PWM)                                                                                                                           |
| Remote On/Off – On:<br>– Off:<br>– Off stand by input current         | open or high impedance<br>2...4 mA current applied via 1KOhm resistor<br>2.5 mA max.                                                    |
| Environmental compliance – Reach<br>– RoHS                            | <a href="http://www.tracopower.com/products/tdr2-reach.pdf">www.tracopower.com/products/tdr2-reach.pdf</a><br>RoHS directive 2011/65/EU |

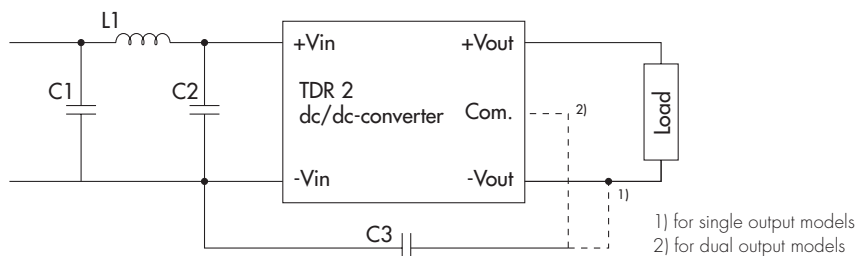
## EMC Consideration

Recommended filter for  
**EN 55022 class A** compliance



| Input models | C1                            | C3                     | L1 value    | order code (SMD type) | datasheet                                                                                          |
|--------------|-------------------------------|------------------------|-------------|-----------------------|----------------------------------------------------------------------------------------------------|
| 5 VDC        | 10 $\mu$ F / 25 V 1812 MLCC   | 220pF / 3 kV 1808 MLCC | 2.2 $\mu$ H | <b>TCK-059</b>        | <a href="http://www.tracopower.com/products/tck059.pdf">www.tracopower.com/products/tck059.pdf</a> |
| 12 VDC       | 6.8 $\mu$ F / 50 V 1812 MLCC  |                        | 18 $\mu$ H  | <b>TCK-046</b>        | <a href="http://www.tracopower.com/products/tck046.pdf">www.tracopower.com/products/tck046.pdf</a> |
| 24 VDC       | 4.7 $\mu$ F / 50 V 1812 MLCC  |                        |             |                       |                                                                                                    |
| 48 VDC       | 4.7 $\mu$ F / 100 V 1812 MLCC |                        |             |                       |                                                                                                    |

Recommended filter for  
**EN 55022 class B** compliance



| Input models | C1 & C2                      | C3                     | L1 value                      | order code (SMD type) | datasheet                                                                                          |
|--------------|------------------------------|------------------------|-------------------------------|-----------------------|----------------------------------------------------------------------------------------------------|
| 5 VDC        | 10 $\mu$ F / 25 V 1812 MLCC  | 220pF / 3 kV 1808 MLCC | 2.2 $\mu$ H                   | <b>TCK-059</b>        | <a href="http://www.tracopower.com/products/tck059.pdf">www.tracopower.com/products/tck059.pdf</a> |
| 12 VDC       | 2.2 $\mu$ F / 50 V 1812 MLCC |                        | 18 $\mu$ H                    | <b>TCK-046</b>        | <a href="http://www.tracopower.com/products/tck046.pdf">www.tracopower.com/products/tck046.pdf</a> |
| 24 VDC       |                              |                        | 27 $\mu$ H                    | <b>TCK-063</b>        | <a href="http://www.tracopower.com/products/tck063.pdf">www.tracopower.com/products/tck063.pdf</a> |
| 48 VDC       |                              |                        | 2.2 $\mu$ F / 100 V 1812 MLCC | 18 $\mu$ H            | <b>TCK-046</b>                                                                                     |

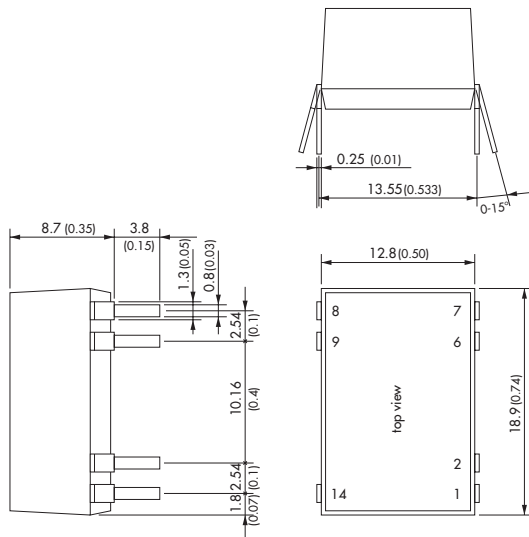
All specifications valid at nominal input voltage, full load and +25°C after warm-up time unless otherwise stated.

## Physical Specifications

|                                                        |                                                                                                                                                              |
|--------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Casing material                                        | non-conductive plastic (UL94V-0 rated)                                                                                                                       |
| Package weight                                         | 4.5 g (0.16 oz)                                                                                                                                              |
| Soldering profile for DIP-package models               | max. 265°C / 10 sec. (wave soldering)                                                                                                                        |
| Lead-free reflow solder process for SMD-package models | as per J-STD-020D.01 (to find at:<br><a href="http://www.jedec.org">www.jedec.org</a> - free registration required)                                          |
| Moisture sensitivity level (for SMD-package models)    | level 2a as per J-STD-033B.01 (to find at:<br><a href="http://www.jedec.org">www.jedec.org</a> - free registration required)                                 |
| Environmental compliance                               | – Reach<br>– RoHS<br><a href="http://www.tracopower.com/products/tdr2-reach.pdf">www.tracopower.com/products/tdr2-reach.pdf</a><br>RoHS directive 2011/65/EU |
| Packaging                                              | – Tube<br>– Tape & Reel (only SMD models, add suffix -TR)<br>10 pcs packing unit<br>200 pcs packing unit                                                     |

## Outline Dimensions

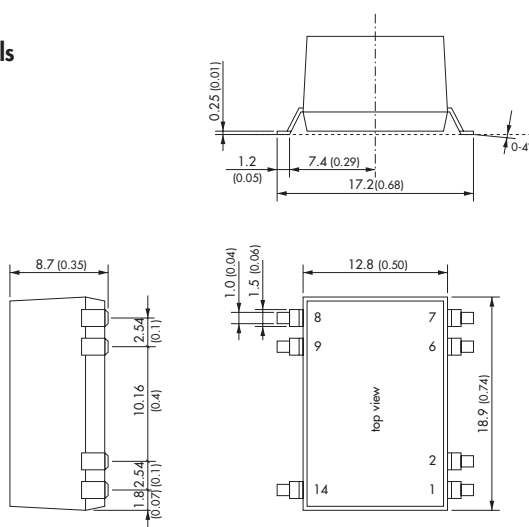
### DIP-Models



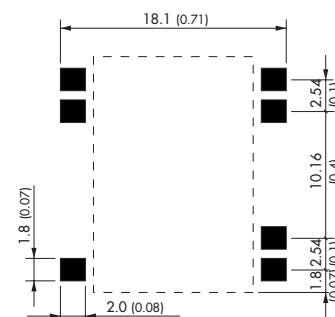
| Pin-Out |               |               |
|---------|---------------|---------------|
| Pin     | Single        | Dual          |
| 1       | –Vin (GND)    | –Vin (GND)    |
| 2       | Remote On/Off | Remote On/Off |
| 6       | NC            | Common        |
| 7       | NC            | –Vout         |
| 8       | +Vout         | +Vout         |
| 9       | –Vout         | Common        |
| 14      | +Vin (Vcc)    | +Vin (Vcc)    |

NC = not to connect

### SMD-Models



### Recommended Solder Pad Dimension:



Dimensions in [mm], ( ) = Inch

Tolerances:  $\pm 0.5$  ( $\pm 0.02$ )

Pin pitch tolerances:  $\pm 0.25$  ( $\pm 0.01$ )

Specifications can be changed without notice! Make sure you are using the latest documentation, downloadable at [www.tracopower.com](http://www.tracopower.com)